

UK Patent Application GB 2 132 825 A

(21) Application No 8230107

(22) Date of filing 21 Oct 1982

(43) Application published  
11 Jul 1984

(51) INT CL  
H02B 5/04

(52) Domestic classification  
H2E CJ

(56) Documents cited

GB 1603943

GB 1427221

GB 1103307

(58) Field of search

H2E

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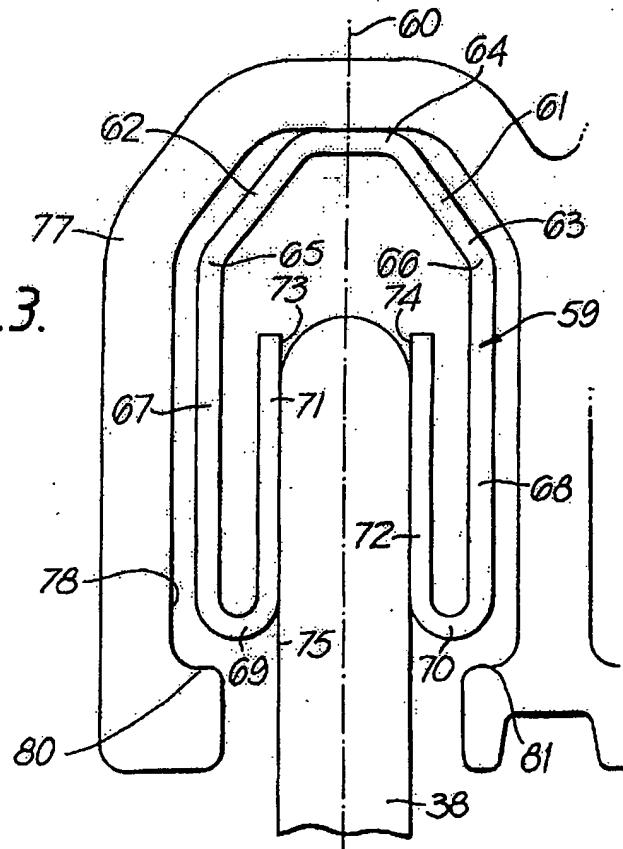
London EC4A 1HY.

(54) Conductor rail

(57) A conductor rail for an electrical distribution system comprises a longitudinally-extending profile (59) having a body part (61) and spaced, substantially parallel wall members (67,68) depending therefrom and defining a central channel adapted to receive a connect-

ing pin. The free edge regions of the wall members are turned inwardly at bends (69,70) to form internal flanges (71,72) having conducting surfaces (73,74) for the connecting pin. This construction gives substantially improved elasticity compared to conventional shapes and thereby improved electrical contact. Elasticity may be further improved by forming the wall members and particularly the flanges (71,72) from thinner material than body part (61).

Fig. 3.

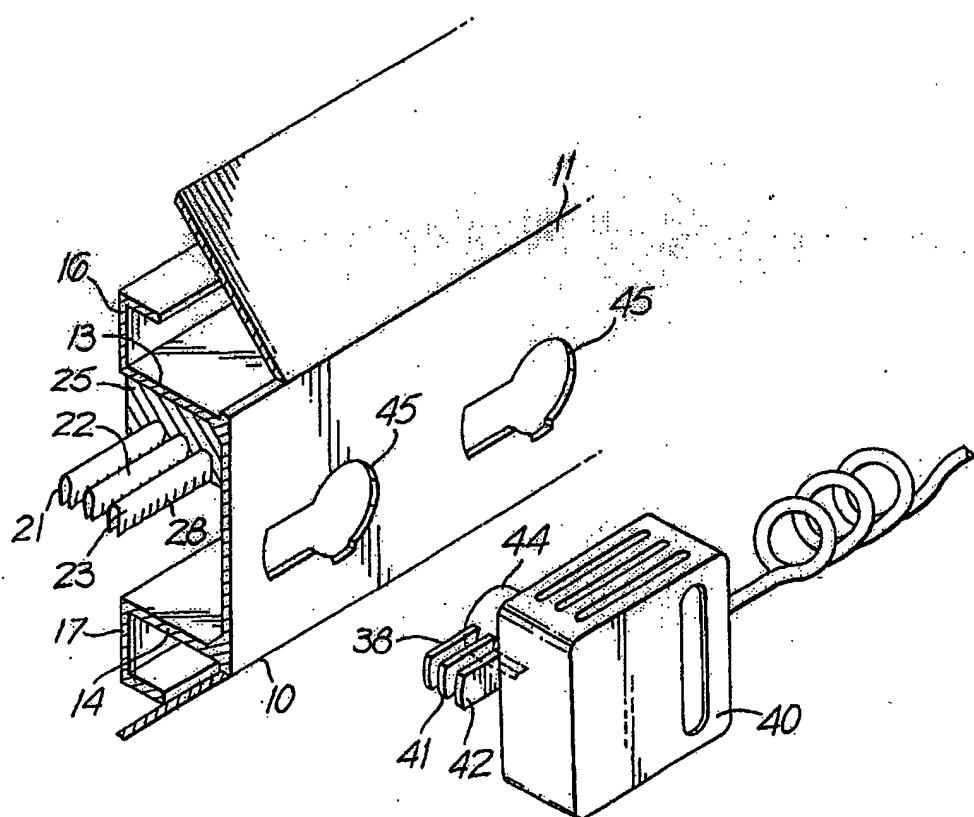


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Fig. 1.



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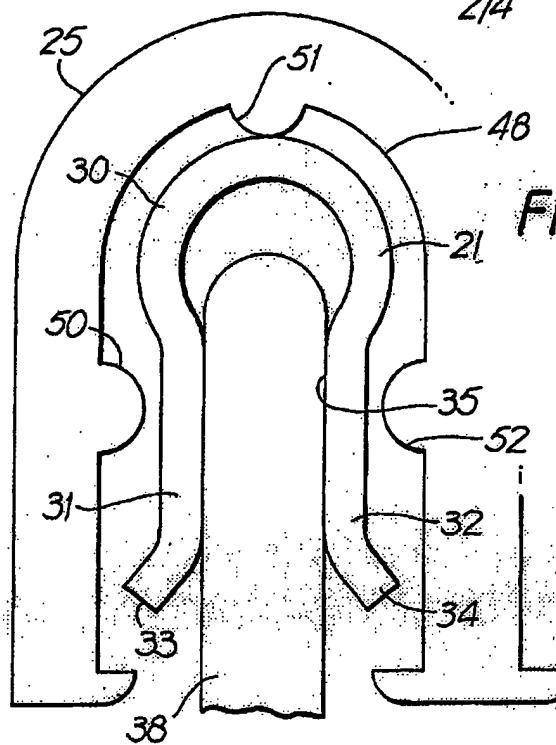


Fig. 2.

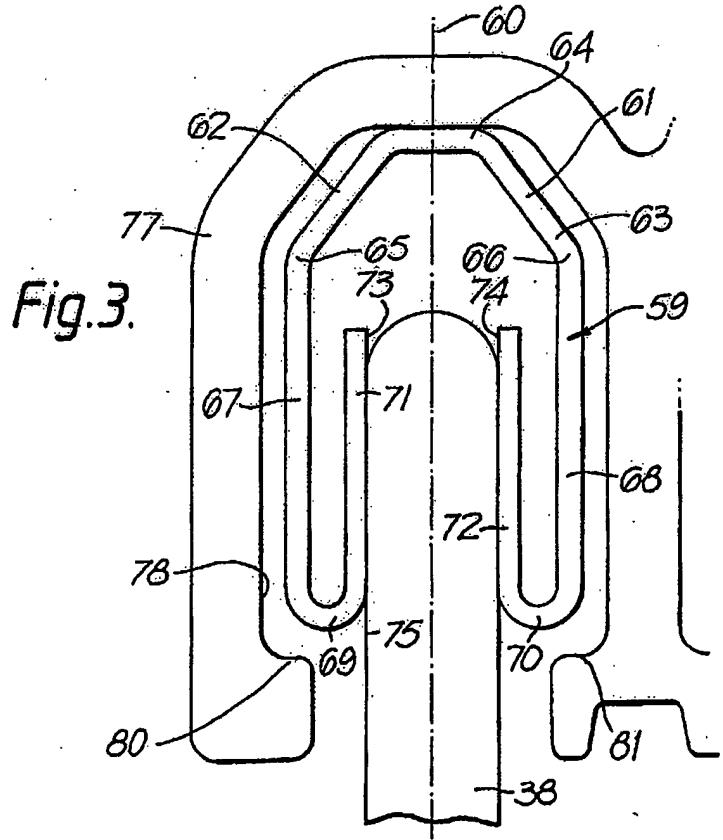


Fig. 3.

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Fig.4.

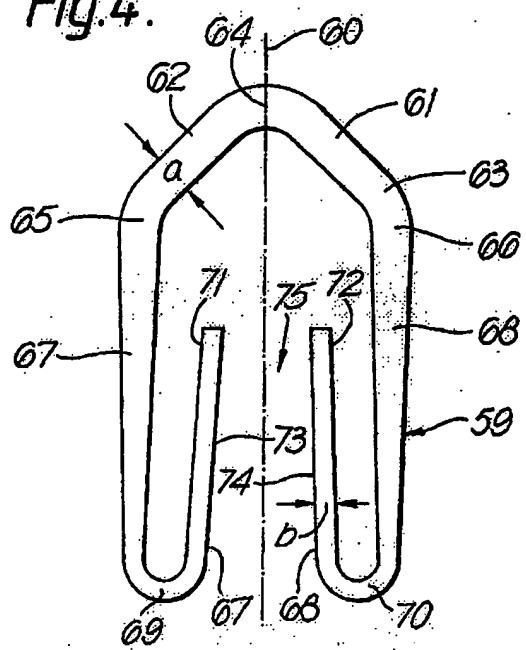
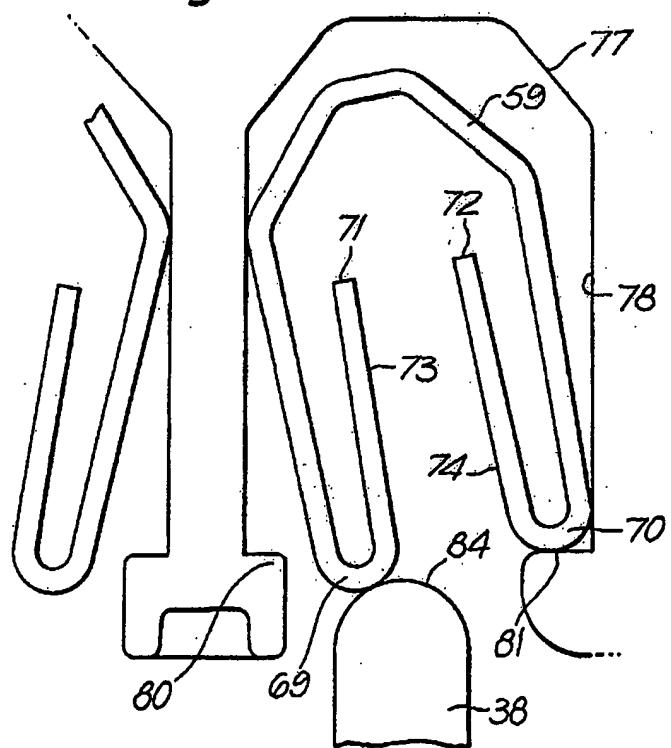


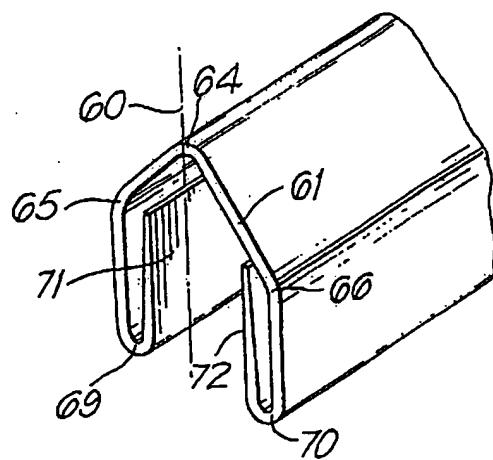
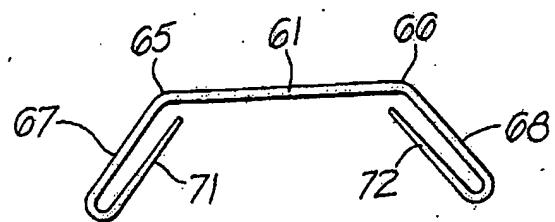
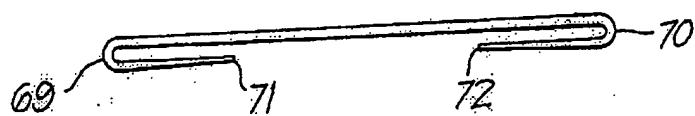
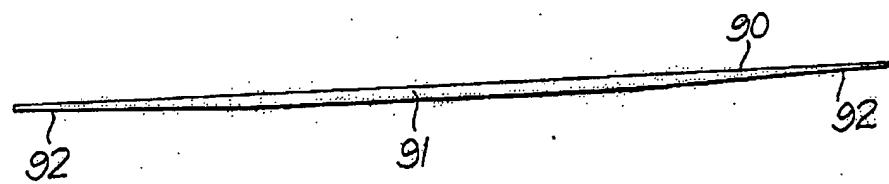
Fig.5.



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Fig. 6.



**SPECIFICATION****Improved conductor rail**

5 This invention relates to continuous conductor rails, and more particularly, but not exclusively, to continuous conductor rails intended for an electrical distribution system in which the conductor rails are enclosed within an elongate conduit which is provided either with a continuous slot, or with spaced openings, allowing access to the conductor rails by a connecting plug. Usually, with such an arrangement, the plug is provided with spaced connector pins, and these are commonly engaged with the conductor rails by inserting the plug into the appropriate opening and then turning the plug to bring the pins into contact with the conductor rails. An example of such an electrical distribution system is described in U.K. Patent Application No. 81 31510.

10 One of the factors to be considered in the design of such a system is the effectiveness of the electrical contact between the connector pins of the plug and the conductor rails when the plug is in the contact position. In order to ensure this connection remains 15 unsatisfactory despite manufacturing tolerances and any wear which might occur during the life of the system, it is essential that a degree of resilience is incorporated into this contact. One way of achieving this is to make each conductor rail generally U-shaped in cross-section, thus defining a channel into which the appropriate connector pin may be fitted. The side walls of the channel are slightly elastic, and the channel is dimensioned such that it is slightly smaller than the width of the connector pin. Satisfactory electrical contact is then achieved by the gripping action of the rail on the pin when the pin is inserted into the channel.

The preferred material for forming the conductor rails is generally copper, which in thin sections has sufficient elasticity to provide the necessary gripping action. Where high current loads are to be carried by the distribution system however, it is necessary to increase the cross-sectional area of each rail so as to increase its current-carrying capacity. This increase in thickness has the effect of decreasing the elasticity of the side walls, and it has been found that above a certain thickness of material, only point contact between the connector pin and the rail occurs. This cannot readily be overcome by increasing the contact pressure exerted by the side walls on the pin, as this leads to an unacceptable increase in wear and in the effort needed to insert the connector pin into the central channel.

The object of the present invention is to provide an improved continuous conductor rail for an electrical distribution system.

According to the present invention, there is provided a continuous conductor rail for use in an electrical distribution system, comprising a longitudinally-extending profile of electrically conductive material having a pair of spaced wall members defining a longitudinally-extending channel adapted to receive a connector pin, the opposed surfaces of said wall members forming substantially parallel continuous conducting surfaces for said connector

pin, whereby the longitudinal edge region of at least one of said wall members is turned inwardly into said channel to provide one of said continuous conducting surfaces, and said longitudinal edge region is elastically deformable at the region where it is turned into said channel so that a connector pin can be gripped between said conducting surfaces.

By forming one of the conducting surfaces on an turned edge region of at least one of the wall members, the elasticity of the rail is substantially increased for a given thickness of material. Furthermore, the effective increase in length of the section correspondingly increases the current-carrying capacity of the rail.

80 Preferably, both of said wall members have longitudinal edge regions which are turned inwardly into said channel to provide said continuous conducting surfaces.

This arrangement is effectively twice as resilient as a construction in which only one wall member has an turned edge.

Advantageously, the conductor rail comprises of integral body part interconnecting said wall members, and said wall members are elastically deformable relative to said body part. In one embodiment of the invention, the material forming said body part is thicker than at least some of the material forming one or both of said wall members.

By providing the conductor rail with a body part which is thicker in cross-section than the integral wall members, the current-carrying capacity of the conductor rail can be increased without reducing the elasticity of the wall members. This also enables the wall members to be made of relatively thin material which can be easily shaped to provide a much higher degree of resilience than is possible with a single thickness of material.

The invention also includes a continuous conductor rail as described herein before, in combination with an electrically-insulating support element therefor, said support element being formed with a longitudinally-extending aperture receiving said conductor rail, and an entrance for said aperture, said conductor rail being disposed in said aperture with the longitudinally-extending channel in the conductor rail opposite the entrance in said support element.

Preferably the conductor rail is mounted in said support element for limited radial movement with respect to the longitudinal axis of said aperture. Suitably, the rail is disposed in said aperture with the turned edge of the or each wall member adjacent said entrance thereto whereby a connector pin may be guided into the channel in said conductor rail.

In order that the invention may be more fully understood, embodiments in accordance therewith will now be described by way of example with reference to the accompanying drawings, in which:

*Figure 1* is a perspective and diagrammatic view, partly in section, of an electrical distribution system incorporating three conductor rails of known construction;

*Figure 2* is a detailed cross-section through part of the insulated support of the electrical distribution system shown in *Figure 1*, illustrating the conven-

tional conductor rail with a connecting pin received within the central channel thereof;

Figure 3 is a cross-section through a similar conductor support, but incorporating a conductor rail according to the present invention;

Figure 4 is a cross-section through another embodiment of conductor rail according to the invention;

Figure 5 is a cross-section through a conductor rail and conductor support similar to that shown in Figure 3 illustrating the entry of a connector pin; and

Figure 6 illustrates the sequence of forming the conductor rail shown in Figure 4.

Referring to the drawings, Figure 1 illustrates an electrical distribution system which incorporates continuous conductor rails of the kind with which this invention is primarily concerned. The system illustrated in Figure 1 includes conductor rails of known construction, and one of these rails is shown in more detail in Figure 2.

The system comprises a continuous conduit 10 having a front wall 11 and upper and lower walls 13 and 14 respectively. The conduit is provided with flanges 16 and 17 which may be used to secure the conduit 10 to a flat surface such as a wall. Front wall 11 is provided with a series of spaced openings 45 each adapted to receive a connecting plug 40.

Enclosed within the conduit are three continuous conductor rails 21, 22 and 23. These rails are supported in an insulated support 25 retained within the conduit 10 adjacent the lower surface of upper wall 13. Conductor rail 21 and part of support 25 are illustrated in detail in Figure 2. Rail 21 comprises a generally U-shaped copper strip having an acute body part 30 terminating in downwardly depending wall members 31 and 32. The wall members and the body part define a longitudinally extending channel 35 which is adapted to receive a connector pin 38 of connecting plug 40. Connecting plug 40 has three connector pins, 38, 41 and 42 corresponding respectively to conductor rails 21, 22 and 23. Contact is made between the pins and the conductor rails by inserting the nose 44 of plug 40 through one of the openings 45 formed in the front wall 11, and then turning the plug in a clockwise direction to insert the connector pins 38, 41 and 42 into the central channel of the corresponding conductor rail.

As will be seen from Figure 2, electrical contact between pin and rail is ensured by dimensioning the conductor rail such that the central channel 35 is slightly smaller than the width of connector pin 38, and the natural resilience of arms 31 and 32 ensure that sufficient pressure is applied to the pin to provide the required electrical contact. The lower edges 33 and 34 of wall members 31 and 32 are flared 55 outwardly to assist in the insertion of pin 38.

As will be seen from Figure 2, the conductor rail 21 is loosely located in a channel 48 formed in the conductor support 25 and is retained in position by ribs 50, 51 and 52 which are moulded on the inside 60 wall of this channel. The free play is provided to take up manufacturing tolerances.

Conductor rails of the kind shown in Figures 1 and 2 are satisfactory where light current loads are being carried by the distribution system, but where it is required to increase the cross-sectional area of the

rail in order to carry more current, problems can arise due to reduced elasticity of the conductor rail. The result of using a heavier gauge of material to form the rail 21 is that, beyond a certain thickness of arms 31, 32 contact between the pin 38 and these arms is reduced to point contact only, and this leads to a number of undesirable side-effects when current is passed, such as increased resistance and heat build up at the contact point. It is not possible to overcome this by reducing the width of the channel so as to increase the contact pressure on the pin, as this leads to increased wear on the pin.

In order to overcome this problem, the present invention proposes a novel form of conductor rail, embodiments of which are shown in Figures 3 to 6. The conductor rail 59 is formed from a conductive sheet material such as copper strip, and in all the embodiments shown is symmetrical about a central axis 60, although this is not essential. The rail comprises a body part 61 of generally inverted V-shape having two body elements 62, 63 directed outwardly from an apex 6. The body elements terminate respectively at bends 65, 66 in downwardly depending wall elements 67, 68, the lower edges 90 of which are turned through approximately 180° at bends 69, 70 to form internal flanges 71, 72. The outer surfaces 73, 74 of these flanges form the conducting surfaces for a connector pin 38, as illustrated in Figure 3. The inner flanges 71 and 72 are inclined 95 slightly towards each other so that, before the connecting pin is inserted, the central channel 75 defined between these flanges is, in cross-section, generally wedge-shaped. As will be seen from Figure 3, when the connecting pin 38 is inserted into this channel 75, the flanges 71, 72 are locally elastically deformed out of this wedge-shape so as to apply a nip to the connecting pin. The elasticity of the rail 59 in a direction normal to axis 60 is substantially increased by the 180° bends 69, 70, and most of the flexing of flanges 71, 72 occurs about these bends. In addition, some flexing of the section takes place at bends 65, 66, and about apex 64. This provides a substantially greater degree of elasticity than the shape shown in Figure 2, and the use of additional material in the section means that higher current loads can be carried within the same available space.

An even greater degree of flexibility is provided in the embodiment shown in Figure 4, in which a dual-thickness profile is used. In this embodiment, the thickness of material forming the rail reduces from bends 65, 66, and the final thickness  $b$  of internal flanges 71, 72 is substantially less than the thickness  $a$  of body part 61. This reduction in thickness has several functions. Firstly, the relatively thin flanges 71, 72 are inherently more resilient than the relatively thick body part 61, and secondly, the use of thin material permits a substantially smaller radius to be used for the 180° bends 69, 70, thus providing a configuration which itself is substantially elastic. Such shaping is only possible due to the thinning of material around bends 69 and 70. Part 61 is thicker to compensate for the thinning and still provide adequate current-carrying capacity. In the embodiments shown, the thickness of the flanges 130 71, 72 is approximately 0.4mm, whereas the thick-

ness of the body part 61 is approximately 0.6mm. These dimensions provide the necessary cross-section for the current to be carried, whilst giving excellent electrical contact between the connecting pin and the rail, although clearly other dimensions may be used depending on the particular application.

The conductor support 77 (Figure 3) in which the conductor rail 59 is mounted is formed from an insulating plastics material such as NORYL (NORYL is a Registered Trade Mark) and has a shaped aperture 78 receiving the conductor rail, the outer edges of the aperture terminating in inwardly-turned ledges 80, 81 which support rail 59 by engagement with bends 69, 70. Rail 59 is loosely located in channel 78, and Figure 5 illustrates, in an exaggerated fashion, how an imperfect alignment of the conductor rail 59 can be accommodated as the connector pin 38 is inserted. The connector pin 38 is provided with a generally spherical end surface 84 which, by engagement with the bends 69 or 70 formed in the conductor rail, will move the conductor rail radially into the correct position in the aperture 78 to engage the flanges 71, 72. It will be appreciated that the resilience of the conductor rail also assists in the insertion of the connector pin where there is some mis-alignment of the conductor rail.

Figure 6 illustrates four stages in forming a conductor rail of the kind shown in Figure 4. The rail is formed from a strip 90 of material such as brass or copper which has a longitudinally-extending central region 91 which is approximately twice as thick as the outer edges 92. This variation in thickness is formed by any suitable process as rolling, slitting, machining or extruding. Alternatively, the effective thickness may be increased by folding to give two or three thicknesses of material.

In the second stage, the outer edges of the strip 90 are turned over towards the centre, to form the flanges 71, 72. Thus turning over can be achieved without fracturing of the material due to the small thickness of the material at the bends 69, 70. In the third stage, the folds 65, 66 are made, to bend out the wall members 67, 68 from the margins of the body portion 61. Finally, the central fold of 64 is made in the body portion 61 along the central axis 60.

It will be appreciated that the number of folds made in the strip contribute substantially to its resilience, and while the section shown in the drawings is a particularly efficient shape both elastically and electrically, many other configurations are possible utilising the principle according to the invention. If required, only one of the wall members 55 may be resilient, in which case the thicker current-carrying part of the conductor rail will comprise the body portion and the opposite wall member.

While the invention has been described as applied to a conductor rail in a particular continuous electrical distribution system, it may equally be applied to any kind of continuous conductor rail.

## CLAIMS

### 65 1. A continuous rail for use in an electrical

distribution system, comprising a longitudinally-extending profile of electrically conductive material having a pair of spaced wall members defining a longitudinally-extending channel adapted to receive

- 70 a connector pin, the opposed surfaces of said wall members forming substantially parallel continuous conducting surfaces for said connector pin, whereby the longitudinal edge region of at least one of said wall members is turned inwardly into said channel to provide one of said continuous conducting surfaces, and said longitudinal edge region is elastically deformable at the region where it is turned into said channel so that a connector pin can be gripped between said conducting surfaces.
- 80 2. A continuous conductor rail as claimed in Claim 1, wherein both of said wall members have longitudinal edge regions which are turned inwardly into said channel to provide said continuous conducting surfaces.
- 85 3. A continuous conductor rail as claimed in Claim 1 or Claim 2, wherein the conductor rail comprises a body part interconnecting said wall members, and said wall members are elastically deformable relative to said body part.
- 90 4. A continuous conductor rail as claimed in Claim 3, wherein, in section, the material forming said body part is thicker than at least some of the material forming one or both of said wall members.
- 95 5. A continuous conductor rail as claimed in Claim 4, wherein said conductor rail is fabricated by folding a flat strip of sheet metal material which is thicker in its central zone than at least one of its edge regions.
- 100 6. A continuous conductor rail as claimed in any of Claims 1 to 5, in combination with an electrically-insulating support element therefor, said support element being formed with a longitudinally-extending aperture receiving said conductor rail, and an entrance for said aperture, said conductor rail being disposed in said aperture with the longitudinally-extending channel in the conductor rail opposite the entrance in said support element.
- 105 7. The combination as claimed in Claim 6, wherein the conductor rail is mounted in said support element for limited radial movement with respect to the longitudinal axis of said aperture.
- 110 8. The combination as claimed in Claim 6 or Claim 7, wherein said conductor rail is disposed in said aperture with the inturned edge of the or each wall member adjacent said entrance thereto whereby a connector pin may be guided into the channel in said conductor rail.
- 115 9. A continuous conductor rail substantially as hereinbefore described with reference to Figures 3, 4, 5 or 6 of the accompanying drawings.